

ARTIFICIAL TURF WITH GRANULE RETAINING FIBERS

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FIELD OF THE INVENTION

10 The present invention relates generally to artificial turf, and more particularly to an artificial turf including a plurality of groups, of fibers, each group including both straight and non-linear fibers sewn into a backing through a common opening, with the non-linear fibers providing captivation of granular infill.

DESCRIPTION OF THE PRIOR ART

15 Artificial turf is used in a variety of areas, such as on athlete playing fields for football, soccer, baseball, tennis, etc. The artificial turf is usually made to simulate a natural grass field. U.S. Patent 5,601,886 by Ishikawa et al. describes an artificial turf consisting of alternate rows of longer and shorter artificial grass filaments sewn into a backing. A layer of sand is deposited into the artificial turf so as to cover the shorter filaments. A disadvantage of this structure is that the sand
20 infill tends to compact and harden, and has an abrasive quality.

U.S. Patent 4,396,653 by Tomarin discloses sewing pile fibers into a backing, and then depositing a bottom layer of rubber-like particles, and then a binder for gluing some of the particles together. A second layer of sand is then deposited over the first layer wherein the depth of the first and second layers is less than the height of the pile fiber.

25 U.S. Patent 6,527,889 by Paschal et al describes a structure that appears similar in purpose to that of Tomarin's, wherein the rubber particles of a first bottom layer are coated with a bonding agent. Application of water to the layer then activates the bonding agent for adhering the particles together. A second, top layer of rubber particles is then deposited over the bottom layer.

U.S. Patent 6,299,959 by Squires et al. discloses a grass-like surface formed with
30 polyethylene co-polymer slit fibers tufted through a fiberglass reinforced backing. Three layers of infill are then deposited. The bottom layer is rubber granules, and the top two layers are each a mixture of rubber and sand.

The above described patents using rubber granules or rubber and sand mixtures provide a more resilient, shock absorbent surface. A disadvantage is that some of the rubber particles become air-borne upon impact with the turf. For example, football players impact turf with shoulders and helmets, etc., bringing the player's faces close or in contact with the turf. The small "rubber granules" are often created by grinding up used automobile tires, and include the various components, including natural and synthetic rubber and ground up steel belt. These finely ground particles can be ingested by players, and may be a health hazard, or at least a potential irritant.

SUMMARY

It is an advantage of this invention in that it provides an artificial turf having an improved stability.

It is a further advantage of this invention in that it provides a combination of good shock absorption with stability of rubber infill.

It is a still further advantage of this invention in that it provides improved retainment of rubber infill in combination with good shock absorption, and reduces the quantity of infill that escapes into the air above the turf.

In one embodiment of this invention, an artificial turf is provided that resists migration of rubber infill into the space above the turf. Artificial grass is attached to and extends upward from a backing material, which may be one or more layers. The artificial grass includes groups of at least two different kinds of fiber sewn through a common path in the backing material. One of the kinds of fibers is an artificial grass blade shaped so as to appear like a blade of grass. The other kind of fiber in each group is pre-stressed/crimped so that the relaxed shape of the fiber is nonlinear, resembling a curlicued or articulated form having lateral excursions. The lateral excursions cause portions of one such pre-stressed fiber to overlap and interfere with another, forming a mesh. The height of the pre-stressed fibers in their relaxed state in the turf is less than the height of the relatively unstressed fiber(s). Resilient granules are embedded in the mesh, and are captivated by the interfering pre-stressed fibers. In one embodiment, the pre-stressed fiber is constructed of nylon material, and the relatively unstressed artificial grass blade of polyethylene.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates an artificial turf according to the present invention;

Fig. 2 illustrates two fibers through one needle, and fiber tension;

5 Fig. 3 is a table of example dimensions of fiber and infill height;

Fig. 4A shows one type of artificial grass fiber construction; and

Fig. 4B shows the fiber of Fig. 4A rolled up.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention will be described herein with reference to particular
10 embodiments thereof, a latitude of modifications, various changes and substitutions are intended,
and it will be appreciated that in some instances some features of the invention will be employed
without a corresponding use of other features without departing from the spirit and scope of the
invention as described with respect to the preferred embodiments set forth herein.

Referring now to Fig. 1 of the drawing, the artificial turf 10 of the present invention is
15 illustrated. A backing material 12 has two different kinds of fiber 14 and 16 sewn into it, with both
fiber 14 and 16 passing through the same passages 18 in the backing 12. Fiber 14 is an artificial
grass blade that can be constructed in a number of ways to give the turf a grass like appearance.
Fiber 16 is pre-stressed into a non-linear shape, creating a mesh for retaining infill 24. The tops 20
and 22 of the fibers are cut, forming a "cut fiber" carpet/artificial turf, resulting in the fiber 14
20 appearing grass-like. The fibers 14 are relatively un-stressed and have only minor deviations from
linearity, similar to a linear/straight grass blade appearance. Fibers 16 are pre-stressed prior to being
sewn into the backing. During the sewing process, fibers 14 and 16 are both threaded together
through the same sewing machine needle passages, and therefore pass through the same openings 18
in the backing through which the needle is inserted. Axial/longitudinal tension on the fibers 14 and
25 16 provided by the sewing machine keep both fibers 14 and 16 under tension, and most importantly,
fibers 16 are held in an uncrimped, straight line. Upon being sewn into the backing 12, the tension
on fiber 16 is released and it returns to its pre-stressed/crimped condition, that could be described as
curlicued. The lateral/horizontal excursions such as excursion "x" of the fibers 16 provide resistance
to migration of particles 24 placed in the artificial turf, which most commonly are ground up used
30 tires, the resulting granules having a resilient, shock absorbing characteristic.

In one embodiment, the fibers 14 are constructed of polyethylene and fibers 16 of nylon. The polyethylene has a slick surface which helps avoid injury from, for example a football player twisting an ankle due to turf resistance/friction. The dimensions of the stitch spacing S and row spacing R, are selected along with the design of the pre-stressed shape of the fiber 16, so that lateral excursions of a fiber 16 from one passage 18 overlap the excursions of a fiber 16 from an adjacent passage 18. In this way, an effective mesh of fiber 16 is formed that resists migration of the rubber particles 24, both upward and horizontally.

Fig. 2 is provided to illustrate the tension applied to the fibers 14 and 16 during the process of sewing. The initial ends 26 of the fibers 14 and 16 are secured during the process. The needle 28 is inserted through the backing 12, taking both fibers 14 and 16 through a common passage 18. A hook 30 grabs the loop of fibers and keeps the fibers from retracting back through the passage 18 as the needle 28 is retracted. The sewing machinery then inserts the needle 30 through the backing again at a stitch space "S" (Fig. 1) from the first space 18 and the hook 30 grabs the material again. A cutting tool (not shown) follows along or is integrated with the hook apparatus 30 and cuts the loop ends 32, at which time the tension on the cut fiber 16 is released and the fiber 16 returns to its curlicued/non-linear state as shown in Fig. 1.

In one embodiment, the fibers 14 are constructed of polyethylene, and extend upward from the backing a distance H1 of approximately 3 inches. The retracted, rest state curlicued fibers 16 extend upward from the backing a distance H2 of approximately $2\frac{1}{2}$ inches. The height H3 of the rubber infill granules 24 in this particular embodiment is approximately $1\frac{3}{4}$ inches. This combination of heights and other examples are listed in Fig. 3. Other dimensions are also included in the spirit of the present invention, as will be apparent to those skilled in the art. In general, the height H2 of the curlicued fiber 16 must be shorter than the height of the relatively straight fiber 14, and the height of the infill H3 is less than the height H2 in order to optimize the captivation of the granules, but can also be somewhat higher, particularly if a different granule material is used above the fibers 16 that is less irritating to those who play on the turf.

As described above, the straight fiber 14 may be constructed from polyethylene, which provides a slippery surface similar to grass. Other materials that simulate the grass-like property of low resistance/friction are also included in the spirit of the present invention. The nylon fiber 16 is selected for its resiliency and ability to hold the granules 24 in the turf. Other materials for fiber 16 that will retain the granules in a similar way are also included in the present invention.

The grass-like fibers 14 can be constructed in a variety of ways that will be apparent to those skilled in the art for use in the turf of the present invention, and the present invention includes the use of these constructions in the turf structure as described in reference to the figures of the present disclosure. Fig. 4A illustrates the construction of one type of grass-like structure for use as an artificial grass blade. A length of polyethylene or other material of width "W" is sliced through in places 38 as indicated. The material is then rolled up, or pre-stressed to automatically roll up, as indicated in Fig. 4B, and when sewn into an artificial turf backing it resembles a blade of grass.

The granules 24 made by grinding up used tires are an example of resilient material that can be used as an infill. Other materials that provide a shock absorbing layer are also included in the present invention, including mixtures of resilient and non-resilient granules, such as a mixture of sand and rubber granules, etc.

While the present invention has been described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended in the foregoing disclosure, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as set forth in the appended claims.